

What is claimed is:

- 1 1. An anti-microbial powder coating composition comprising one or more
2 anti-microbial agents impact fused to particles of a resin-based powder.
- 1 2. The composition of claim 1 wherein the anti-microbial agent is
2 substantially entirely impact fused to the surface of the resin-based powder particles.
- 1 3. The composition of claim 2 wherein the anti-microbial agent is an anti-
2 microbial metal or metal ion.
- 1 4. The composition of claim 3 wherein the anti-microbial metal or metal ion
2 is silver.
- 1 5. The composition of claim 4 wherein the silver is in the form of a silver ion
2 carried by a zeolite.
- 1 6. The composition of claim 4 wherein the silver is supplied by a silver salt.
- 1 7. The composition of claim 4 wherein the silver is supplied by a silver
2 zirconium phosphate.
- 1 8. The composition of claim 4 wherein the silver is supplied by an organic
2 composition containing silver.
- 1 9. The composition of claim 5 wherein the powder coating composition
2 comprises a thermosetting composition based on a cured polyester resin composition.

1 10. The composition of claim 9 wherein the polyester resin composition is
2 cured with a triglycidylisocyanurate.

1 11. The composition of claim 10 wherein the silver containing zeolite is about
2 1 to 5 percent by weight of the sum of the components comprising the powder coating
3 composition.

1 12. The composition of claim 7 wherein the powder coating composition
2 comprises a thermosetting composition based on a cured epoxy resin composition.

1 13. The composition of claim 12 wherein the silver zirconium phosphate is
2 about 1 percent by weight of the sum of the components comprising the powder coating
3 composition.

1 14. The composition of claim 5 wherein the powder coating composition
2 comprises a radiation curable composition based on an ultraviolet curable polyester resin.

1 15. The composition of claim 14 wherein the ultraviolet curable polyester
2 resin is an unsaturated polyester resin.

1 16. The composition of claim 14 wherein the silver zeolite is about 1 to 2
2 percent by weight of the sum of the components comprising the powder coating
3 composition.

1 17. The composition of claim 1 including one or more anti-microbial metal or
2 metal ions homogeneously dispersed within particles of the powder coating composition.

- 1 18. The composition of claim 17 wherein the homogeneously dispersed anti-
2 microbial metal or metal ion is silver.
- 1 19. The composition of claim 18 wherein the homogeneously dispersed silver
2 is in the form of a silver zirconium phosphate.
- 1 20. The composition of claim 18 wherein the homogeneously dispersed silver
2 is in the form of a silver ion carried by a zeolite.
- 1 21. The composition of claim 19 wherein the homogeneously dispersed silver
2 zirconium phosphate is about 1 percent by weight of the sum of the components
3 comprising the powder coating composition.
- 1 22. The composition of claim 20 wherein the homogeneously dispersed silver
2 zeolite is about 1 to 5 percent by weight of the powder coating composition.
- 1 23. A method for preparing an anti-microbial powder coating composition
2 comprising impact fusing one or more anti-microbial agents to particles of a resin-based
3 powder.
- 1 24. The method of claim 23 further including absent the anti-microbial agent,
2 blending the components of the powder coating composition using a premixer, feeding
3 the mixture into an extruder, heating the mixture to a temperature high enough to melt it,
4 cooling the melt, and processing the solid extrudate into a coating powder.

1 25. The method of claim 24 wherein impact fusing includes impact fusing the
2 anti-microbial agent to the coating powder so that the anti-microbial agent is substantially
3 entirely fused to the surface of the coating powder particles.

1 26. The method of claim 24 wherein impact fusing the anti-microbial agent
2 includes mixing the anti-microbial agent with the coating powder, blending the mixture
3 in a high intensity mixer, cooling the mixture and processing the mixture into an anti-
4 microbial coating powder.

1 27. The method of claim 26 further including adjusting the blending time to
2 approximately achieve the glass transition temperature.

1 28. A method for preparing an anti-microbial powder coating composition
2 comprising blending the components of the powder coating composition using a
3 premixer, feeding the mixture into an extruder, heating the mixture to a temperature high
4 enough to melt it, cooling the melt, processing the solid extrudate into a coating powder,
5 and impact fusing one or more anti-microbial agents to the particles of the coating
6 powder.

1 29. The method of claim 28 wherein impact fusing one or more anti-microbial
2 agents to the particles of the coating powder includes mixing the anti-microbial agent
3 with the coating powder, blending the mixture in a high intensity mixer, cooling the
4 mixture and processing the mixture into an anti-microbial coating powder.

1 30. The method of claim 29 further including adjusting the blending time to
2 approximately achieve the glass transition temperature.

1 31. An anti-microbial powder coating composition comprising an anti-
2 microbial silver zirconium phosphate that is homogeneously dispersed within particles of
3 a resin-based powder.

1 32. The composition of claim 31 wherein the powder coating composition
2 comprises a thermosetting composition based on a cured polyester resin composition.

1 33. The composition of claim 32 wherein the polyester resin composition is
2 cured with a urethane curing agent.

1 34. The composition of claim 33 wherein the silver zirconium phosphate is
2 about 1 percent to 2 percent of the sum of the components comprising the powder coating
3 composition.

1 35. An anti-microbial powder coating composition comprising one or more
2 anti-microbial metals or metal ions homogeneously dispersed within particles of a
3 radiation curable resin-based powder.

1 36. The composition of claim 35 wherein the anti-microbial metal or metal ion
2 is silver.

1 37. The composition of claim 36 wherein the silver is a silver ion carried by a
2 zeolite.

1 38. The composition of claim 36 wherein the resin-based powder is
2 ultraviolet-radiation curable.

- 1 39. The composition of claim 38 wherein the resin is a polyester resin.
- 1 40. The composition of claim 35 further comprising a cure initiator.
- 1 41. The composition of claim 40 wherein the cure initiator is a free radical
2 producing cure initiator.
- 1 42. The composition of claim 40 wherein the cure initiator is a cation
2 producing cure initiator.
- 1 43. The composition of claim 36 wherein the silver zeolite is about 1 to 2
2 percent by weight of the sum of the components comprising the powder coating
3 composition.
- 1 44. A powder coating composition comprising one or more anti-microbial
2 metals or metal ions homogeneously dispersed within particles of a resin-based powder,
3 said resin-based powder formulated such that the components do not inhibit the migration
4 or decrease the solubility of said anti-microbial metals or metal ions.
- 1 45. The powder coating composition of claim 44 wherein the anti-microbial
2 metal or metal ion is silver.
- 1 46. The powder coating composition of claim 45 wherein the silver is in the
2 form of a silver ion carried by a zeolite.

1 47. The powder coating composition of claim 45 wherein the component that
2 inhibits the migration or decreases the solubility of said silver is an ionic halide that is not
3 already associated with silver.

1 48. The powder coating composition of claim 47 wherein the concentration of
2 the ionic halide in the powder coating composition is less than 300 parts per million.

1 49. The powder coating composition of claim 47 wherein the concentration of
2 the ionic halide in the powder coating composition is less than 50 parts per million.

1 50. The powder coating composition of claim 47 wherein the concentration of
2 the ionic halide in the powder coating composition is less than 10 parts per million.

1 51. The powder coating composition of claim 47 wherein said ionic halide is
2 chloride.

1 52. The powder coating composition of claim 46 wherein said silver zeolite is
2 about 3 percent to 12 percent by weight of the sum of the components of the powder
3 coating composition.